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IS 3810-2 (2003): Solid Mineral Fuels - Vocabulary, Part 2: Terms Relating to Sampling, Testing and Analysis [PCD 7: Solid Mineral Fuels]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

ठोस खनिज ईंधन — पारिभाषिक शब्दावली

भाग 2 नमूना लेने, परीक्षण और विश्लेषण से संबंधित शब्द

(पहला पुनरीक्षण)

Indian Standard

SOLID MINERAL FUELS — VOCABULARY

PART 2 TERMS RELATING TO SAMPLING, TESTING AND ANALYSIS

(First Revision)

ICS 01.040.73; 73.040; 75.160.10

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FOREWORD

This Indian Standard (Part 2) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Solid Mineral Fuels Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was published in 1977 and was largely based on ISO recommendations R1213-2 : 1971. ISO/R 1213-2 : 1971 has subsequently been revised in 1992 and now is available as ISO 1213-2 : 1992 'Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis'. The Committee, therefore, decided to revise this standard to align it with ISO 1213-2 : 1992. Consequently, the title has been modified as 'Solid mineral fuels — Vocabulary: Part 2 Terms relating to sampling, testing and analysis'.

Certain definitions have been modified in this standard that are not aligned with ISO 1213-2 : 1992 (*see 3.64, 3.81, 3.110 and 3.141*). Therefore, this standard has not been published as dual number standard.

Reference may be made to ISO 565 : 1990 'Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings' for interpreting terms given in 3.113 and 3.191.

IS 3810 consists of two parts. The other part is:

(Part 1) : 1977 Terms relating to coal preparation.

Indian Standard

SOLID MINERAL FUELS — VOCABULARY

PART 2 TERMS RELATING TO SAMPLING, TESTING AND ANALYSIS

(*First Revision*)

1 SCOPE

This standard (Part 2) defines terms commonly employed in the sampling, testing and analysis of solid mineral fuels.

1.1 Alternative names are given for several terms: in some cases, however, the use of the alternative name is deprecated (as indicated).

1.2 An alphabetical index, with numerical cross-reference is provided.

2 REFERENCES

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
460 (Part 1) : 1985	Test sieves: Part 1 Wire cloth test sieves (<i>third revision</i>)

3 TERMS AND DEFINITIONS

3.1 Abrasion — Loss of material from particle surfaces of a solid mineral fuel, or from other surfaces in contact with the particles, caused by friction between contacting surfaces.

3.2 Abrasion Index — The total mass lost by the abrasion of four carbon steel blades when rotated in a specified mass of a solid mineral fuel under specified conditions, expressed in milligrams of metal lost per kilogram of solid mineral fuel.

3.3 Accuracy — The closeness of agreement between an observation and the 'true' value.

NOTE — The accuracy of a result should not be confused with its precision.

3.4 Adventitious Ash — Extraneous ash (deprecated): Ash arising from mineral matter associated with, but not inherent in, a solid mineral fuel.

3.5 Air-Dried Basis — A means of expressing an analytical result based on the condition in which a solid mineral fuel is in equilibrium with atmospheric humidity.

NOTE — The solid mineral fuel in this state is composed of residual moisture, mineral matter and organic matter.

3.6 Anthracite — Coal of high rank, with a low volatile matter content and a semi-metallic lustre, and which does not soften or swell when heated.

3.7 Apparent Relative Density — The ratio of the mass of a dry solid mineral fuel to the mass of a volume of water equal to the apparent volume of the solid mineral fuel at a specified temperature.

NOTE — The apparent relative density should not be confused with the bulk density (*see* 3.21).

3.8 Ash — The residue obtained by incineration of a solid mineral fuel under specified conditions.

3.9 Ash Analysis — The analysis of ash for its elemental composition.

NOTE — The elements usually determined are silicon, aluminium, iron, magnesium, titanium, calcium, sodium, potassium, phosphorus and sulphur and these are usually expressed as oxides.

3.10 Ash Fusibility — Characteristic physical state of the ash obtained by heating under specified conditions.

NOTES

1 Ash fusibility is determined under either oxidizing or reducing conditions.

2 *See also* 3.43, 3.44, 3.58, 3.76 and 1.100.

3.11 Ash Viscosity — A measure of the resistance to flow of ash in the fused state.

3.12 Base/Acid Ratio — The ratio of the mass of basic oxides [Iron(III) oxide, calcium oxide, magnesium oxide, disodium oxide and dipotassium oxide] to the mass of acidic oxides [silica, aluminium oxide and titanium (IV) oxide] in ash.

NOTE — This ratio can be used in the determination of the fouling factor and the slagging factor.

3.13 Batch — A quantity of a solid mineral fuel produced at one time under relatively uniform conditions.

3.14 Bias — A systematic error which leads to results which are persistently higher or persistently lower than the 'true' value.

3.15 Bituminous Coal — A general descriptive term for coal of rank between anthracite and brown coal/lignite.

NOTES

1 The vitrinites in all coals in the bituminous range melt and form a coke when the coal is heated above 400°C in the absence of air.

2 In some countries coals of rank immediately below that of bituminous coal are referred to as sub-bituminous coals.

3.16 Blast Furnace Coke — Strong, large coke for use in blast furnaces.

NOTES

1 Blast furnace coke is generally produced from blends of bituminous coals, which may incorporate additives.

2 Blast furnace coke usually has a low reactivity to carbon dioxide.

3.17 Bottom Size; Lower Size — The size corresponding to the 95 percentile on the cumulative size distribution curve of a material, that is, the largest sieve size on which 95 percent of the material is retained.

3.18 Breakage — Particle size reduction resulting from impact and/or compression.

3.19 Breeze — The undersize after separating the smallest size of graded coke.

NOTE — Breeze is usually less than 10 mm in size.

3.20 Brown Coal and Lignite — Coals of low rank characterized by high inherent moisture, high volatile matter and low calorific value.

NOTE — In some countries the terms are used to describe all low rank coals up to bituminous coals. In other countries the coals at the higher end of the range are referred to as sub-bituminous coals.

3.21 Bulk Density — The mass of a portion of a solid mineral fuel divided by the volume of the container which is filled by that portion under specified conditions.

3.22 Carbominerite — Collective term for intergrowths of minerals and macerals.

NOTE — The various types of carbominerite with their compositions are given in Table 1.

Table 1 Types and Compositions of Carbominerite
(Clause 3.22)

Sl No. (1)	Type (2)	Volume Percentage of Minerals (3)
i)	Carbargillite	20 to 60, clay minerals
ii)	Carbopyrite	5 to 20, sulphides
iii)	Carbankerite	20 to 60, carbonates
iv)	Carbosilicite	20 to 60, quartz
v)	Carbopolyminerite ¹⁾	20 to 60, various minerals

NOTE — The term is used also for carbopolyminerite containing a Max of 5 percent of mineral matter, provided that sulphides form a substantial part of the mineral matter.

3.23 Carbon in Mineral Matter — The carbon in the mineral matter carbonates of a solid mineral fuel.

3.24 Carboxyreactivity — The rate of reaction of a solid mineral fuel with carbon dioxide under specified conditions.

3.25 Char — The solid, partially or non-agglomerated carbonaceous material produced by the pyrolysis of solid mineral fuels.

3.26 Chute — An inclined trough for conveying solid mineral fuel to a lower level.

3.27 Clinkering — The aggregation of particles of ash after it has melted during the course of combustion of a solid mineral fuel or during gasification.

NOTE — The aggregated particles may include small amounts of unburnt solid mineral fuel.

3.28 Coal — Combustible sedimentary rock formed from altered plant remains consolidated under superimposed strata.

NOTE — The characteristics of different coals are due to differences in source plant material, in the conditions and the degree of change that the material has undergone in its geological history, and in the range of impurities present. Coals can be characterized macroscopically by their lithotype composition and microscopically by their maceral and microlithotype compositions.

3.29 Coalification — Process by which sedimented compacted plant remains are transformed into coal.

NOTE — This process is characterized by an increase in the carbon content in the plant remains and a decrease in the volatile matter yield from the plant remains. As coalification proceeds, the reflectances of the macerals tend to increase. Vitritine is used as a reference material for the determination of the rank of coal because its reflectance increases uniformly with the extent of coalification.

3.30 Coefficient of Variation — The standard deviation, s , expressed as a percentage of the absolute value of the arithmetic mean, $|x|$

$$v = \frac{s}{|x|} \times 100$$

NOTE — This term is usually designated as v .

3.31 Coke — The solid, agglomerated carbonaceous residue produced by the pyrolysis of coal in the absence of air.

3.32 Combustible Matter — Theoretical state of a solid mineral fuel without moisture and mineral matter other than pyritic sulphur and sulfidic sulphur.

3.33 Combustible Sulphur — The sulphur which reacts with oxygen when a solid mineral fuel is burnt under specified controlled conditions.

3.34 Common Sample — A sample collected for more than one intended use.

3.35 Complete Seam Profile Sample for Each Bench — Collective designation of the coal samples taken separately from each coal bench and band of the tested seam or a part of it which is a section of a thick seam.

3.36 Coning and Quartering — An operation in which the thoroughly mixed material is piled into a conical heap on a clean, dry, non-absorbent surface, then flattened into a uniform circular layer and divided into four equal portions by cuts at right angles, one pair of opposite quarters being retained while the other pair is rejected.

3.37 Constant Mass Division — The method of increment or sample division in which the portions retained from individual increments, partial samples or gross samples are of uniform mass.

3.38 Continuous Sampling — The taking of a sample from every unit of the solid mineral fuel being handled.

3.39 Correlation Coefficient — A measure of the degree of correlation between the members of paired sets.

3.40 Crucible Swelling Number — The number which defines, by reference to a series of standard profiles, the size and shape of the residue obtained when a specified mass of coal is heated in a covered crucible under specified conditions.

3.41 Crush (to) — To reduce the particle size of a sample to produce mainly coarse particles.

NOTE — See also 3.70.

3.42 Cut Coke — Screened coke from which the oversize has been reduced by mechanical means and rescreened.

3.43 Deformation Interval; Softening Interval — The interval between the deformation temperature and the hemisphere temperature.

3.44 Deformation Temperature — The temperature at which deformation of a test piece prepared from ash, by a specified procedure, occurs.

NOTE — The deformation observed takes the following:

- a) when using cylindrical (or cubical) test pieces, a change of the surface and the rounding of the edges at the rim or corner;
and
- b) when using pyramidal test pieces, the rounding of the tip of the test piece.

3.45 Dilatation — A measure of the volume change produced by heating a coal through its plastic range under specified conditions.

3.46 Dirt Band — Shale band (deprecated): A layer of mineral matter lying parallel to the bedding plane in a seam of coal.

3.47 Divided Increment — The part obtained from the division of the increment in order to decrease its mass.

NOTE — Such division may be done with or without prior size reduction.

3.48 Dry Ash-Free Basis — A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be free from both moisture and ash.

3.49 Dry Basis — A means of expressing an analytical result based on the condition in which the solid mineral fuel is free from moisture.

3.50 Dry Mineral-Matter-Free Basis — A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be free from both moisture and mineral matter.

3.51 Duplicate Determination — The determination of a characteristic on two portions of the same test sample carried out by the same operator using the same apparatus but at different times.

3.52 Duplicate Sampling — A particular case of replicate sampling with only two replicate samples.

3.53 Error — The difference between the observation and the 'true' value, which can be designated systematic (bias) or random.

3.54 Falling Stream — A stream of solid mineral fuel in free fall, for example from the end of a conveyor.

3.55 Fixed Carbon — The remainder after the percentages of the moisture, ash and volatile matter are subtracted from 100.

3.56 Fixed Rate Division — The method of increment or sample division in which the portions retained from individual increments, partial samples or gross samples have a mass proportional to the mass of the increment, partial sample or gross sample.

3.57 Fixed Sulphur — The sulphur which is present in the solid residue (non-volatile), after the pyrolysis of a solid mineral fuel at a particular temperature.

3.58 Flow Temperature — The temperature at which a test piece, prepared from ash by a specified procedure, its losses profile and flows to the extent that its height is one-third of its height at the hemisphere temperature.

3.59 Fluidity — A measure of the viscosity of a coal in its plastic state determined under specified conditions.

3.60 Formed Coke — Coke specially prepared from coal by processes involving the compaction of particles into a regularly shaped artifact.

3.61 Forms of Sulphur — A collective term for the pyritic sulphur, sulphate sulphur and organic sulphur in a solid mineral fuel.

NOTE — For the purposes of this definition, elemental sulphur and monosulfides, which may be present in certain solid mineral fuels, are disregarded.

3.62 Fouling Factor — A measure of the tendency of ash to form sintered deposits in the convective zone of a furnace.

3.63 Foundry Coke — Very strong, very large, dense coke for use in foundry cupola furnaces.

NOTE — It is prepared in coke ovens from selected coking coal blends, and may incorporate additives.

3.64 Free Moisture — That quantity of water which is physically adhering to coal. In essence, it is that quantity of water which is in excess of the moisture holding capacity of coal.

3.65 Gas Coke — Coke usually made from high volatile bituminous coal at high temperature in gasmaking carbonization plants.

3.66 General Analysis — The determination of the chemical and physical characteristics of a solid mineral fuel, other than the determination of total moisture.

3.67 General Analysis Test Sample — A sample, crushed to pass a sieve, of nominal size of openings 212 μm , complying with IS 460 (Part 1), used for the determination of most physical and chemical characteristics of a solid mineral fuel.

3.68 Graded Coke — Coke which has been screened between two specified sizes.

3.69 Gray-King Coke Type — The type, denoted by a letter, with a subscript in certain cases, which defines, by reference to a series of standard profiles, the size, strength and texture of the coke residue obtained when a specified mass of coal is heated in a retort tube under specified conditions.

3.70 Grind (to); Mill (to) (Deprecated) — To reduce the particle size of a sample to produce fine particles.

NOTE — See also 3.41.

3.71 Gross Calorific Value at Constant Volume — The amount of heat liberated per unit mass of a solid mineral fuel when it is burned in oxygen saturated with water vapour in a bomb calorimeter under specified conditions.

NOTE — The gross calorific value at constant volume is the negative value of the gross specific energy of combustion.

3.72 Gross Sample — The quantity of a solid mineral fuel consisting of all the increments or partial samples taken from a sampling unit, either in the condition as taken or after the increments have been individually reduced and/or divided.

3.73 Hand Placing — The operation by which an attempt is made to pass each particle of solid mineral fuel through a stationary sieve by presenting it to the sieve in all possible orientations but without the use of force.

3.74 Hand Shaking; Manual Shaking — The operation in which a sieve is held in the hands and is given a gentle horizontal oscillatory motion.

3.75 Hardgrove Grindability Index — A measure of the grindability of a coal determined by testing a specially prepared sample in standard apparatus.

3.76 Hemisphere Temperature — The temperature at which the height of a test piece, prepared from ash

by a specified procedure, is equal to half the width of the base, and its shape becomes approximately hemispherical.

3.77 High Temperature Coke — The solid, agglomerated carbonaceous residue of the pyrolysis of coal at temperatures above 850°C.

3.78 Humic Acids — A group of complex organic, amorphous compounds of high relative molecular mass which occur as free acids and as metal salts (humates).

3.79 Hydrogen in Mineral Matter — The hydrogen in the water of constitution in the mineral matter of a solid mineral fuel.

3.80 Hydoreactivity — The rate of reaction of a solid mineral fuel with water vapour under specified conditions.

3.81 Hydro Cyclone — A device in which the principle of centrifugal force is applied to effect a separation in water.

3.82 Ignition Temperature — The *Min* temperature at which a solid mineral fuel liberates enough volatile matter to form, together with the surrounding atmosphere, a flammable mixture.

3.83 Increment — A portion of a solid mineral fuel collected in a single operation of the sampling instrument.

NOTE — For some types of sampling instrument, a single operation consists of a double pass (back and forth) through the stream.

3.84 Inerts (Inorganic) — Constituents of a solid mineral fuel which decrease its efficiency in a specific use.

3.85 Inerts (Organic) — The maceral components of a coal which do not soften or swell during the process of carbonization.

3.86 Inherent Ash — Ash arising from mineral matter present in the original plant material from which the solid mineral fuel was formed and from mineral matter incorporated intimately in the solid mineral fuel during the coalification process.

3.87 Intermittent Sampling — The taking of a sample from only certain units of the solid mineral fuel being handled.

3.88 Isrid Indices — The percentages of a specially prepared sample of coke remaining on a test sieve of 40 mm nominal size of openings (round hole) and passing a test sieve of 10 mm nominal size of openings (round hole), denoted by I_{40} and I_{10} respectively, after the sample has been subjected to 500 revolutions by a specified procedure in a rotating drum.

NOTE — Other indices, for example I_{20} , may be reported in addition to, or in place of, I_{40} , if required.

3.89 Laboratory Sample — A sample prepared from the gross or partial sample as delivered to the laboratory and from which further samples are prepared for test purposes.

3.90 Large Coal — Coal above a specified lower limiting size, without any upper size limit.

3.91 Large Coke — Coke with lower size of 20 mm and above, with or without upper size limit.

3.92 Lot — A discrete quantity of a solid mineral fuel for which the overall quality needs to be determined.

3.93 Low Temperature Coke — The solid, agglomerated carbonaceous residue of the pyrolysis of coal at a temperature between 500°C and 850°C.

3.94 Lump Section — A piece of solid mineral fuel of size suitable for polishing and examination under the microscope.

NOTE — One face of the lump section, usually that perpendicular to the bedding plane, is ground and polished.

3.95 Maceral — Microscopically recognizable organic constituent of coal analogous to the minerals of inorganic rocks, but differing from them in that a maceral has no characteristic crystal form and is not constant in chemical composition.

NOTES

1 The macerals are distinguished from one another, microscopically on the basis of their differences in such properties as reflectance, colour, morphology, size and hardness. They originate from the remains of different tissues of plants and their physical and chemical properties change as coalification proceeds.

2 The classification of the macerals in bituminous coal and anthracite is given in Table 2.

3.96 Maceral Group — Collective term for macerals having broadly similar properties in a single coal of specific rank.

NOTE — Three maceral groups are recognized, namely, vitrinite (huminites in brown coal), liptinite and inertinite. The maceral groups in bituminous coal and anthracite, and their subdivisions, are given in Table 2.

3.97 Mass Basis Sampling — The taking of increments in uniform mass intervals throughout the sampling unit.

NOTE — Each increment or divided increment constituting the partial sample or the gross sample should be of almost uniform mass.

3.98 Maximum Reflectance — Highest value of reflectance obtained when any polished section of a particle or lump of coal is rotated in its own plane in linearly polarized light.

3.99 Mean Size — The weighted average particle size of any sample.

3.100 Melting Interval — The interval between the hemisphere temperature and the flow temperature.

Table 2 Maceral Groups in Bituminous Coal and Anthracite and Their Subdivision
(Clauses 3.95 and 3.96)

SI No.	Maceral Group	Maceral	Submaceral
(1)	(2)	(3)	(4)
i)	Vitrinite	Telinite Collinite	Telinite 1 Telinite 2 Telocollinite Gelocollinite Desmocollinite Corpocollinite
ii)	Liptinite ¹⁾	Vitrodetrinite Sporinite Cutinite Resinite Suberinite ²⁾ Alginite Liptodetrinite Bituminite	
iii)	Inertinite	Micrinite Macrinite Semifusinite Fusinite Sclerotinite Inertodetrinite	Pyrofusinite Degradofusinite

¹⁾ This maceral group has also been referred to as exinite but the use of this term is now deprecated.

²⁾ Occurs in post-carboniferous bituminous coals.

3.101 Microlithotype — Naturally occurring maceral or association of macerals with a *Min* band width of 50 nm.

NOTES

1 Microlithotypes are classified in one of three categories, namely monomaceral, bimaceral and trimaceral microlithotypes, according to whether they contain significant proportions of macerals of one, two or three maceral groups. For the bimaceral and trimaceral microlithotypes, the proportion of an individual maceral group is more than 5 percent by volume in each case.

2 The classification of the main microlithotypes in bituminous coal and anthracite and their maceral group compositions are given in Table 3.

3.102 Micum Indices — The percentages of a specially prepared sample of coke remaining on a test sieve of 40 mm nominal size of openings (round hole) and passing a test sieve of 10 mm nominal size of openings (round hole), denoted by M_{40} and M_{10} respectively, after the sample has been subjected to 100 revolutions by a specified procedure in a rotating drum.

NOTE — Other indices, for example M_{60} , M_{20} , may be reported if required.

3.103 Milled Coke — Coke reduced in size by grinding (milling) so that a high proportion will pass a fine sieve, for example a sieve of nominal size of openings 212 μ m.

3.104 Mineral Matter — The inorganic material, excluding moisture but including water of constitution, in a solid mineral fuel.

NOTE — Mineral matter is calculated on a mass basis either from a direct determination at low temperature or from the ash yield at high temperature.

Table 3 Classification of the Main Microlithotypes in Bituminous Coal and Anthracite

(Clause 3.101, Note 2)

Sl No.	Microlithotype	Maceral-group Composition (Total ≥ 95 Percent by Volume, Mineral – Free Basis)
(1)	(2)	(3)
i)	Monomaceral:	
	Vitrite	Vitrinite
	Liptite	Liptinite
	Inertite	Inertinite
ii)	Bimaceral:	
	Clarite	Vitrinite + Liptinite
	Durite	Inertinite + Liptinite
	Vitrinertite	Vitrinite + Inertinite
iii)	Trimaceral:	
	Trimacerite	Vitrinite + Liptinite + Inertinite

3.105 Mineral Sulphur — The sum of the pyritic sulphur and sulfate sulphur in a solid mineral fuel.

NOTE — For the purposes of this definition, elemental sulphur and monosulfides, which may be present in certain solid mineral fuels, are disregarded.

3.106 Minerite — Collective term for intergrowths of minerals with different macerals where the proportion of the total is more than 60 percent by volume or if more than 20 percent by volume of sulfide minerals are present.

3.107 Moist, Ash-Free Basis — A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be ash-free but with a moisture content equal to the moisture-holding capacity.

3.108 Moist, Mineral-Matter-Free Basis — A means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be mineral-matter-free but with a moisture content equal to the moisture-holding capacity.

3.109 Moisture-Holding Capacity — The moisture content of a solid mineral fuel in equilibrium with an atmosphere of 96 percent relative humidity at a temperature of 30°C determined under specified conditions.

3.110 Moisture in Air-Dried Sample — The moisture in the solid mineral fuel sample after it has attained approximate equilibrium with the atmosphere to which it is exposed.

NOTE — Moisture content of air dried coal varies and depends on the temperature and relative humidity of the air to which it is exposed. As such it is necessary to determine moisture content of different samples of coal under standard conditions. For this purpose the coal is equilibrated in an atmosphere of 60 percent relative humidity and 40°C temperature. The moisture determined under this condition shall be taken as reference moisture for all purposes.

3.111 Moisture in the General Analysis Sample —

The moisture content of the general analysis sample of a solid mineral fuel after it has attained approximate equilibrium with the atmosphere in the laboratory and which is removable under specified conditions.

3.112 Net Calorific Value at Constant Volume —

The gross calorific value at constant volume less the latent heat of evaporation of the water originally contained in the fuel and that formed during its combustion.

NOTE — The net calorific value at constant volume is the negative value of the net specific energy of combustion.

3.113 Nominal Top Size — The smallest sieve in the range included in the R 20 series (see ISO 565, square hole) on which not more than 5 percent of the sample is retained.

NOTE — See also 3.191.

3.114 Off-Line Sample Preparation — Sample preparation performed manually or by mechanical equipment not integral with the mechanical sampling system.

3.115 On-Line Sample Preparation — Sample preparation by mechanical equipment integral with the sampling system.

3.116 Organic Carbon; Combustible Carbon — The carbon in the organic matter of a solid mineral fuel.

3.117 Organic Coal Substance — That part of a coal which contains all of the organically combined carbon, hydrogen, nitrogen, oxygen and sulphur.

3.118 Organic Hydrogen — The hydrogen in the organic matter of a solid mineral fuel.

3.119 Organic Sulphur — The sulfur which is bound in the organic matter of a solid mineral fuel.

3.120 Outlier — A result which appears to be in disagreement with others from the same material and which arouses suspicion that there has been a mistake in the sampling, sample preparation or analysis.

3.121 Oxidizing Atmosphere — A gaseous medium consisting of oxygen, air, carbon dioxide, water vapour or a mixture of these, irrespective of the proportions used.

3.122 Oxyreactivity — The rate of reaction of a solid mineral fuel with oxygen under specified conditions.

3.123 Partial Sample — A sample representative of a part of the whole sampling unit, constituted in order to prepare laboratory samples or test samples.

NOTE — A partial sample may be obtained by combining all increments from a sampling unit into two or more sets, each set being composed of consecutive increments, the number of which need not be the same in all sets.

3.124 Particle Size — The size of the sieve opening through which the particle will just pass. This may refer to sieves with round or square shaped holes; the shape of the holes shall be stated.

3.125 Particle Size Reduction — The process of crushing or grinding the sample to reduce the particle size.

3.126 Participate Block — Solid block consisting of particles of crushed coal representative of the sample, bound in resin, cast in a mould and with one face ground and polished.

3.127 Pass (in Sample Division) — The passage of an increment or a sample once through a sample divider.

3.128 Petroleum Coke — Solid agglomerated product consisting principally of carbon, obtained most often by thermal cracking of materials derived from petroleum.

3.129 Porosity of Coke — The ratio of the volume of the voids within a piece of coke to its apparent volume.

NOTE — It is the difference between the true relative density and the apparent relative density of a sample of coke expressed as a proportion of the true relative density.

3.130 Post Reaction Strength — A measure of the residual strength of a coke after it has been subjected to a reactivity test.

3.131 Precision — A measure of the extent to which observations within a set agree with each other.

NOTE — A determination may be made with great precision and the standard deviation of a number of determinations on the same sampling unit may therefore be low, but the results will be accurate only if they are free from bias.

3.132 Primary Increment — The increment taken at the first stage of sampling, prior to any sample division and/or sample reduction.

3.133 Production Seam Profile Sample — The sample taken from the section of the seam being worked.

3.134 Proximate Analysis — The analysis of a solid mineral fuel reported in terms of moisture, volatile matter, ash and fixed carbon.

3.135 Pyritic Sulphur — The sulphur present in the mineral matter of a solid mineral fuel as pyrite or marcasite.

3.136 Random Error — Error that has an equal probability of being positive or negative.

NOTE — The mean of the random errors resulting from a series of observations tends towards zero as the number of observations increases.

3.137 Random Reflectance — Reflectance of any polished section of a particle or a lump of coal when

determined in unpolarized light without rotation of the specimen.

NOTE — The term random reflectance has replaced the terms mean reflectance and average reflectance to avoid any possible confusion arising from the meaning of the words 'mean' and 'average' in the mathematical sense.

3.138 Range — The difference between the greatest and least values of a number of observations.

3.139 Rank — Position of a coal in the coalification series indicating maturity in terms of chemical and physical properties.

NOTE — Higher rank coals are of greater maturity.

3.140 Reactivity — The rate of reaction of a solid mineral fuel with a given agent under specified conditions.

NOTE — See also 3.24, 3.80 and 3.122.

3.141 Reducing Atmosphere — A gaseous medium consisting of methane, carbon monoxide, hydrogen or a mixture of these, irrespective of the proportions used.

NOTE — A mixture of carbon dioxide and hydrogen may also be used as reducing medium.

3.142 Reflectance — Percentage of the normal incident light reflected from a polished surface.

NOTE — In the context of petrography, reflectance refers to measurements made on coal under oil.

3.143 Reflectance Standard — Polished surface of a material of known reflectance which is used for calibrating reflectance measuring equipment.

NOTE — It is essential that the reflectance standard meets stringent requirements with regard to the properties of the material of which it is composed, and the way in which it is mounted and prepared.

3.144 Relevant Bias — Bias that is of practical importance, whether economic, scientific, legal or social.

3.145 Repeatability — Precision under repeatability conditions.

3.146 Repeatability Conditions — Conditions where independent observed values or test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

3.147 Repeatability Critical Difference — The value less than or equal to which the absolute difference between two final values, each representing a series of observed values or test results obtained under repeatability conditions, may be expected to be, with a specified probability.

NOTE — Examples of final values are the mean and the median of the series of observed values or test results; the series itself may consist of only one single observation.

3.148 Repeatability Limit — The value less than or equal to which the absolute difference between two single observed values or test results obtained under repeatability conditions may be expected to be, with a probability of 95 percent.

NOTES

1 The symbol used is r .

2 The repeatability limit corresponds to the repeatability critical difference for two single observed values or test results and a probability of 95 percent.

3.149 Repeatability Standard Deviation — The standard deviation of observed values or test results obtained under repeatability conditions.

NOTES

1 It is a measure of the dispersion of the distribution of observed values or test results under repeatability conditions.

2 Similarly 'repeatability variance' and 'repeatability coefficient of variation' could be defined and used as measures of the dispersion of observed values or test results under repeatability conditions.

3.150 Replicate Sampling — The taking from the sampling unit of increments which are combined in rotation into different containers to give two or more samples of approximately equal mass, each being representative of the whole sampling unit.

NOTE — See also 3.52.

3.151 Reproducibility — Precision under reproducibility conditions

3.152 Reproducibility Conditions — Conditions where observed values or test results are obtained with the same method on identical test material in different laboratories with different operators using different equipment.

3.153 Reproducibility Critical Difference — The value less than or equal to which the absolute difference between two final values, each representing a series of observed values or test results obtained under reproducibility conditions may be expected to be with a specified probability.

NOTE — Examples of final values are the mean and the median of the series of observed values or test results; the series itself may consist of only one single observation.

3.154 Reproducibility Limit — The value less than or equal to which the absolute difference between two single observed values or test results obtained under reproducibility conditions may be expected to be, with a probability of 95 percent.

NOTES

1 The symbol used is R .

2 The reproducibility limit corresponds to the reproducibility critical difference for two single observed values or test results and a probability of 95 percent.

3.155 Reproducibility Standard Deviation — The

standard deviation of observed values or test results obtained under reproducibility conditions.

NOTES

1 It is a measure of the dispersion of the distribution of observed values or test results under reproducibility conditions.

2 Similarly 'reproducibility variance' and 'reproducibility coefficient of variation' could be defined and used as measures of the dispersion of observed values or test results under reproducibility conditions.

3.156 Riffle — A non-mechanical divider in which the material is divided by means of alternate parallel slots, each of the same width, feeding into two opposite and separate containers.

3.157 Roga Index — A measure of the caking power of a coal in terms of the mechanical strength of the coke obtained by carbonization, under specified conditions, of an intimate mixture of the coal and standard anthracite.

3.158 Sample (Noun) — A portion taken from a to be representative of it with regard to the characteristic to be investigated.

3.159 Sample (to) (Verb) — To take a portion of a material which is representative of the whole.

3.160 Sample Division — The process in sample preparation whereby the sample is divided into separate representative portions, one or more of which is retained.

3.161 Sample Preparation — The process of bringing samples to the condition required for analysis or testing.

NOTE — Sample preparation covers mixing, sample division, particle size reduction and sometimes air drying of the sample and may be performed in several stages.

3.162 Sample Reduction — The process in sample preparation whereby the particle size of the sample is reduced by crushing or grinding.

3.163 Sampling Frame — A parallel-sided frame used for taking a stopped-belt increment of a solid mineral fuel.

NOTE — The distance between the parallel sides of the frame should be not less than 2.5 times the nominal top size of the solid mineral fuel.

3.164 Sampling Unit — A quantity of a solid mineral fuel, the sampling of which results in one gross sample.

NOTE — There may be one or more sampling units per lot.

3.165 Seam Section — A sample of a coal seam taken from roof to floor, either as one representative mass or split into a number of subsections of different qualities.

3.166 Segregation — The accidental separation of particles of different physical characteristics.

3.167 Shale — A generic term for certain fine-grained sedimentary rocks, commonly occurring as an impurity in coal seams.

NOTE — This term should not be used as a general term for washery rejects.

3.168 Shatter Index — The percentage of a specially prepared sample of coke remaining on a test sieve of stated size of openings after the sample has been subjected to a specified dropping test.

3.169 Sieving Test Machine — A machine designed to simulate the hand shaking procedure specified in the method for carrying out a size analysis.

3.170 Silica Ratio — The ratio of the mass of silica to the total mass of silica, iron (III) oxide, calcium oxide and magnesium oxide in ash, expressed as a percentage.

NOTE — This ratio gives an indication of the refractoriness of the ash and the tendency to form slag.

3.171 Size Analysis; Sieve Analysis (Deprecated) — The process or the result of the separation of a sample into size fractions with defined limits, the proportions of the fractions being expressed as percentages of the total sample.

3.172 Size Analysis Sample — A sample taken specifically for particle size analysis.

3.173 Sized Coal; Graded Coal (Deprecated) — Coal which has been screened between two specified sizes.

3.174 Size Distribution; Size Consist (Deprecated) — The proportions of various particle sizes in a product.

3.175 Size Fraction — The part of the sample belonging to a specified size range limited by either one or two sieve sizes.

3.176 Size Range — The top size (upper-size) and the bottom size (lower size) of a solid mineral fuel.

3.177 Slagging Factor — A measure of the tendency of ash to form fused deposits in the radiant zone of a furnace.

3.178 Small Coal; Smalls (Deprecated) — Coal with a specified nominal top size but with no lower size limit.

NOTE — The nominal top size is usually between 50 mm and 4 mm.

3.179 Small Coke — Coke with nominal top size of 20 mm or smaller.

3.180 Standard Deviation — The positive square root of the variance.

NOTE — This term is usually designated as s .

3.181 Stratified Random Sampling — The taking of an increment at random within the mass interval

or time interval determined for mass basis sampling or time basis sampling respectively.

3.182 Struck Levelling — A method of levelling the surface of a solid mineral fuel in a container when determining bulk density, whereby a straight edge is slid across the top of the container, any piece of solid mineral fuel which touches the straight edge being removed.

3.183 SubMaceral — Subdivision of a maceral based on slight morphological and physical differences.

3.184 Sulphate Sulphur — The sulphur present in the mineral matter of a solid mineral fuel as sulphate.

3.185 Sulphur in Ash — The sulphur which is present in the ash after a solid mineral fuel is burnt under specified controlled conditions.

3.186 Systematic Sampling — The taking of increments at equal intervals of time, space or mass over the whole lot or sampling unit, the first increment being taken at random within the first such interval.

3.187 Test Portion — The quantity of material taken from the test sample and used for one determination.

3.188 Test Sample — A sample which is prepared to meet the requirements of a specific test.

3.189 Thermal Stability — The dimensional stability of a solid mineral fuel heated under specified conditions.

3.190 Time Basis Sampling — The taking of increments in uniform time intervals throughout the sampling unit.

NOTE — Each increment or divided increment constituting the partial sample or the gross sample should be of a mass proportional to the flow rate of the solid mineral fuel stream at the time of taking the increment.

3.191 Top Size; Upper Size — The size corresponding to the 5 percentile on the cumulative size distribution curve of a material, that is, the largest sieve size on which 5 percent of the material is retained.

3.192 Total Carbon — The sum of the carbon in the organic matter and the carbon in the mineral matter of a solid mineral fuel.

3.193 Total Hydrogen — The sum of the organic hydrogen, the hydrogen in the mineral matter and the hydrogen in the moisture of a solid mineral fuel.

3.194 Total Moisture — The moisture in the solid mineral fuel as sampled, and removable under specified conditions.

3.195 Total Moisture Sample — A sample taken specifically for the determination of total moisture.

3.196 Total Oxygen — The sum of the oxygen in the organic matter, the oxygen in the mineral matter and the oxygen in the moisture of a solid mineral fuel.

3.197 Total Sulphur — The sum of mineral and organic sulphur in a solid mineral fuel.

3.198 True Relative Density — The ratio of the mass of a sample of dry solid mineral fuel ground to pass a 212 μm sieve to the mass of an equal volume of water (at a specified temperature).

NOTE — Grinding to 212 μm is intended to minimize the error due to the presence of pores.

3.199 Ultimate Analysis — The analysis of a solid mineral fuel reported in terms of its carbon, hydrogen, nitrogen, sulphur and oxygen contents.

NOTE — Oxygen content is frequently estimated by difference.

3.200 Variance — The mean square of deviations from the mean value of a set of observations.

NOTE — This term is usually designated as V .

3.201 Volatile Matter — The loss in mass, corrected for moisture, when a solid mineral fuel is heated out of contact with air under specified conditions.

3.202 Volatile Sulphur — The sulphur liberated among the volatile products in the pyrolysis of a solid mineral fuel.

3.203 Washed Coal — Coal which has been treated by a wet cleaning process.

3.204 Water of Constitution — Water chemically bound to the mineral matter and remaining after the determination of total moisture.

3.205 Zero Standard — Non-reflecting standard used for calibrating reflectance-measuring equipment.

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This Indian Standard has been developed from Doc: No. PCD 7(1838).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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